ISBN -0-7743-9145-6

STANDARDS DEVELOPMENT BRANCH OMOE
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ACCOMPLISHMENTS
OF
SCIENTIFIC RESEARCH
IN THE MINISTRY OF THE ENVIRONMENT
ONTARIO

1983 - 84

EXTERNAL GRANTS & CONTRACTS

MARCH 1984

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1984

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Ministry
of the
Environment

The Honourable
Andrew S. Brandt
Minister

Brock A. Smith
Deputy Minister

HAZA TS
AN S BRANCH
1 VENUE WEST
TO

HAZARDOUS CONTAMINANTS
AND STANDARDS BRANCH
135 ST. CLAIR AVENUE WEST
TORONTO, ONTARIO M4V 1P5

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TD
178.7C36
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ACCOMPLISHMENTS
OF SCIENTIFIC RESEARCH
IN THE
MINISTRY OF THE ENVIRONMENT

GRANTS AND CONTRACTS
FUNDED FROM PROVINCIAL LOTTERY PROCEEDS
AND
MINISTRY REGULAR BUDGET

MARCH 1984

POLICY AND PLANNING BRANCH
RESEARCH COORDINATION OFFICE

HAZARDOUS CONTAMINANTS
AND STANDARDS BRANCH
135 ST. CLAIR AVENUE WEST
TORONTO, ONTARIO M4V 1P5
3/4/84

MOE GOAL STATEMENT:

"To achieve and maintain a quality of the Environment - including air, water and land - that will protect human health and the ecosystem and will contribute to the well-being of the people of Ontario."

TABLE OF CONTENTS

Page

INTRODUCTION 1

SUMMARY OF MOE RESEARCH PLANNING PROCESS 2

TECHNOLOGY TRANSFER AND UTILIZATION OF RESULTS 7

I PROJECTS COMPLETED BEFORE 1983 9

- Accomplishments of Completed Projects 15

II PROVINCIAL LOTTERY PROJECTS CONTINUED FROM 1983-84 18

III REVIEW OF NEW PROJECTS STARTED IN 1983-84 20

IV NEW RESEARCH NEEDS

- Impact of Environmental Health Related Research 25
- Financial Information 27

SUMMARIES OF INDIVIDUAL PROJECTS

1. Cleanup of Hazardous Contaminants and Spills 30
    1a. Waste Disposal and Treatment 31
    1b. Environmental Planning and Management .. 33
2. Research to Develop Cost-Effective Technology for Improvement in:
    2a. Drinking Water 36
    2b. Sewage and Sludge Treatment 38
    2c. Landfill Construction and Operation 41

Page

2d. Air Quality and Effects on Health and the Environment 43

2e. Water Quality and Effects on Health and the Environment 49

3. Research to Control Health Hazards and the Environmental Effects of Contaminants 52

3a. Hazardous Contaminants and their Interaction 53

3b. Analytical Procedures 62

INTRODUCTION:

The growing concern of both public and government over the threat from environmental pollution on public health and the total environment has resulted in the dedication of funds to environmental and health-related scientific research. These funds were made available to the Ministry of the Environment Research Program from two main sources:

1. Provincial Lottery Proceeds; and
2. Ministry Regular Budget.

Additional funds are also spent on research-related activities by Ministry Branches and Regions in the form of analyses, internal complementary projects, and other ancillary services.

These dedications originate from the fact that solutions to todays complex environmental problems will only be achieved through problem-oriented scientific research on, for example, the minute quantities of contaminants, studies to investigate the interaction and fate of hazardous chemicals, their effects on the quality of the environment and human health, contaminants removal from drinking and waste waters, treatment of industrial wastes, and information required for standard setting.

The increasing complexity of these problems has led the Ministry to revise and improve its research management practices and to develop a new Research Planning Process, which starts with defining needs to guide the development of projects and finally puts strong emphasis on use of new technology.

The purpose of this report is to provide the public and scientific community with a summary of Ministry research projects undertaken externally.

SUMMARY OF MOE RESEARCH PLANNING PROCESS:

The document entitled "Research Planning Process", February 1983, describes the major steps, organizational responsibilities and timing of the Ministry's Research Planning Process. The latter is aimed at the identification of research priorities, the allocation of resources on a Ministry-wide basis, the management of research activities, and the ultimate utilization of project results for the solution of environmental problems and the protection of public health from pollution.

The Research Planning Process is designed in the context of the Ministry's Corporate Strategic Plan in order to:

- ensure that research is consistent with Ministry goals and objectives;
- allow Branches and Regions to identify research requirements and priorities and develop appropriate research programs through the air, water, waste, and method development working groups;
- coordinate multi-Branch research programs;
- allocate resources based on established Ministry priorities;
- distribute research results and recommendations; and
- evaluate research performance.

The overall plan is summarized in the following diagrams.

DIAGRAM 1

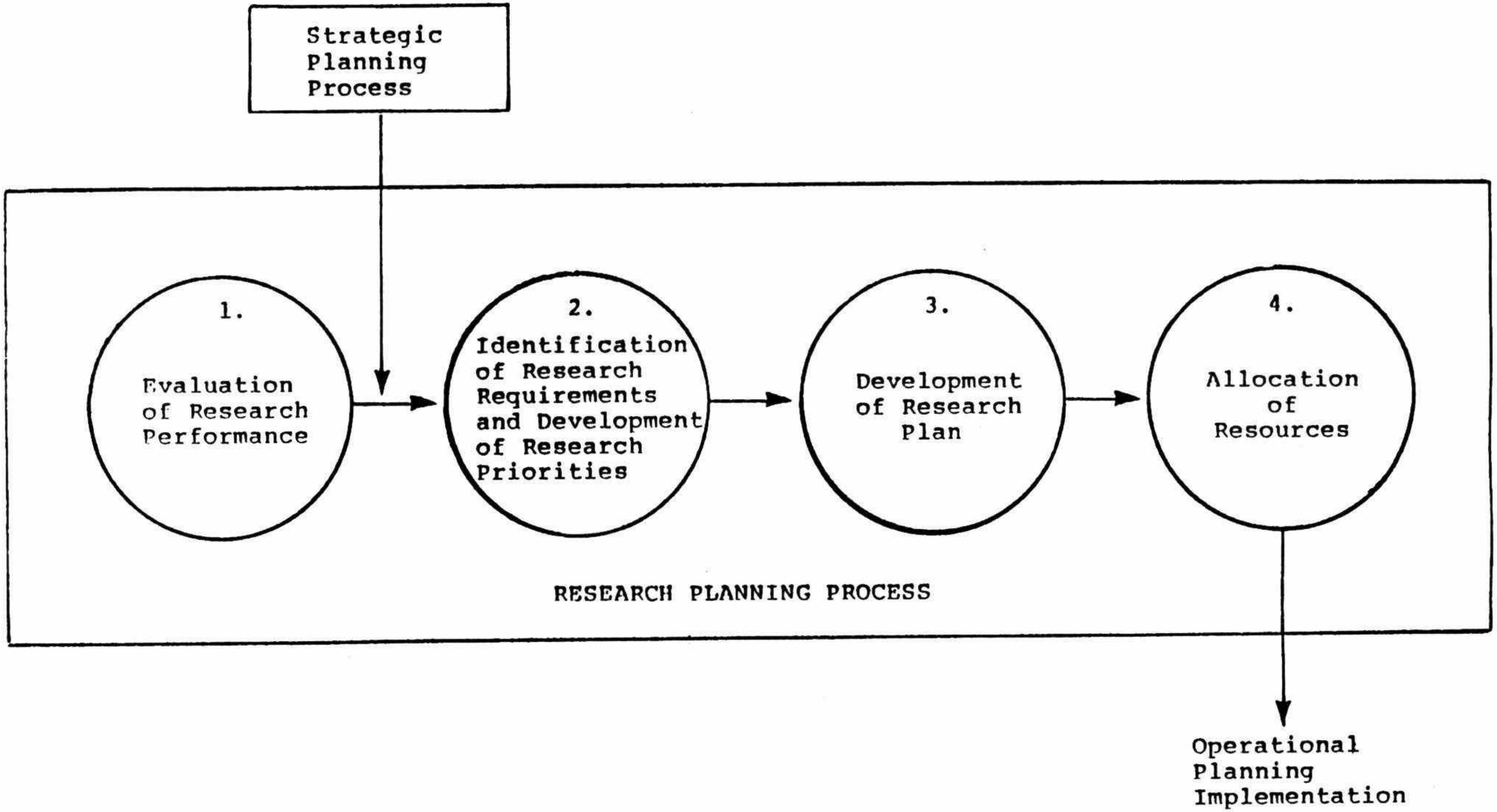
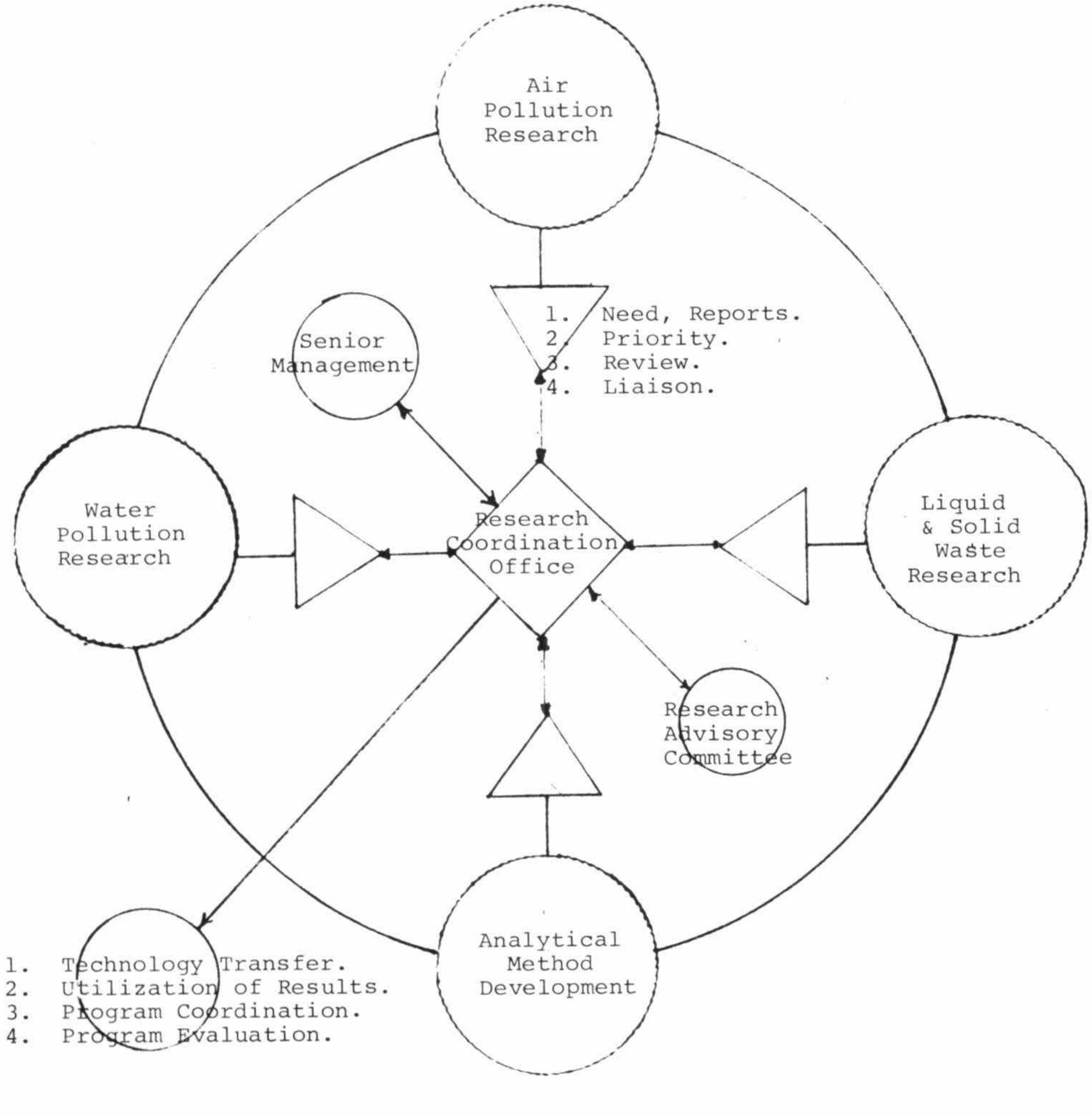

Strategic Planning Process
1.
Evaluation of Research Performance
2.
Identification of Research Requirements and Development of Research Priorities
3.
Development of Research Plan
4.
Allocation of Resources
RESEARCH PLANNING PROCESS
Operational Planning Implementation

DIAGRAM 2


Air Pollution Research
1. Need, Reports.
2. Priority.
3. Review.
4. Liaison.
Senior Management
Water Pollution Research
Research Coordination Office
Liquid & Solid Waste Research
Research Advisory Committee
Analytical Method Development
1. Technology Transfer.
2. Utilization of Results.
3. Program Coordination.
4. Program Evaluation.

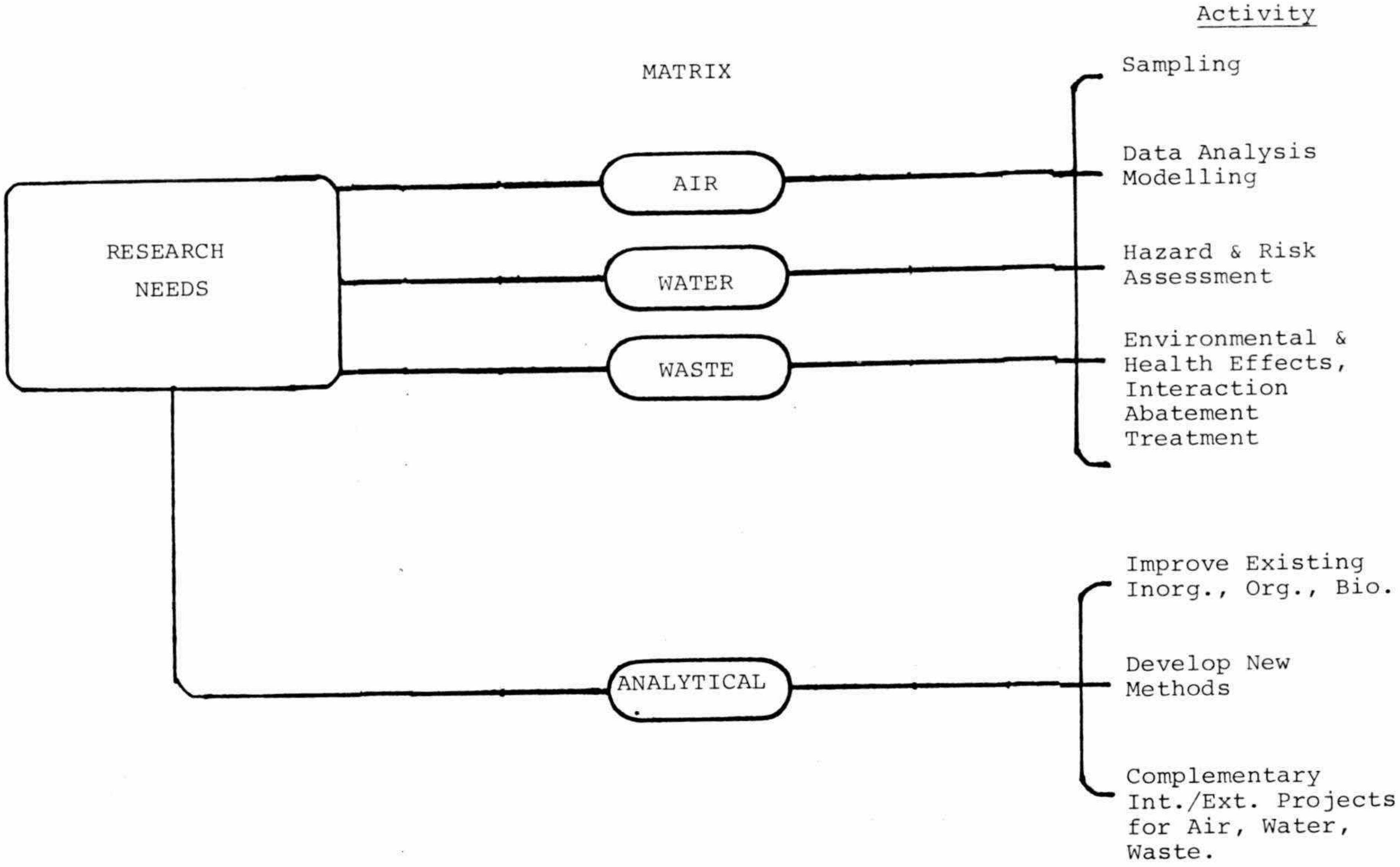
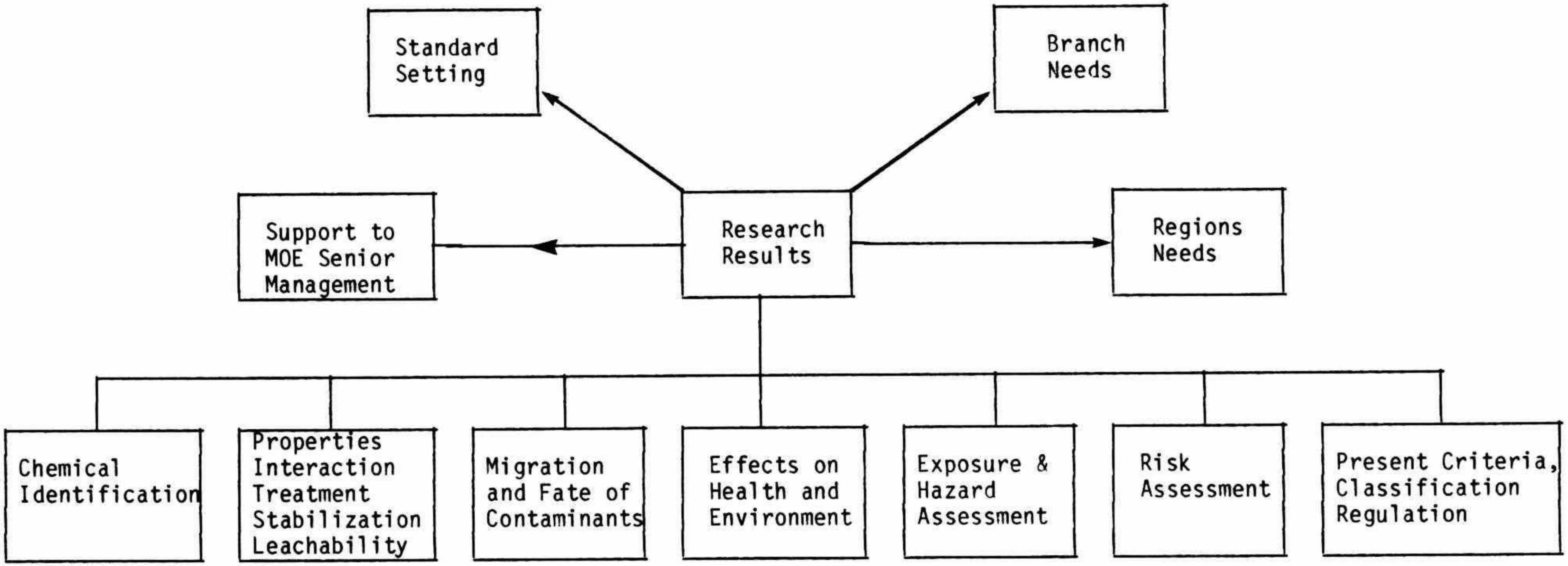

MATRIX
Activity
RESEARCH NEEDS
AIR
WATER
WASTE
ANALYTICAL
Sampling
Data Analysis
Modelling
Hazard & Risk
Assessment
Environmental &
Health Effects,
Interaction
Abatement
Treatment
Improve Existing
Inorg., Org., Bio.
Develop New
Methods
Complementary
Int./Ext. Projects
for Air, Water,
Waste.

DIAGRAM 3

DIAGRAM 4


Standard Setting
Branch Needs
Support to MOE Senior Management
Research Results
Regions Needs
Chemical Identification
Properties Interaction Treatment Stabilization Leachability
Migration and Fate of Contaminants
Effects on Health and Environment
Exposure & Hazard Assessment
Risk Assessment
Present Criteria, Classification Regulation

Impact of Scientific Research on MOE Organizations

TECHNOLOGY TRANSFER AND UTILIZATION OF RESULTS:

The research program has laid particular stress on technology transfer and utilization of research results.

a) Conferences and Seminars:

The Research Advisory Committee has sponsored four Technology Transfer Conferences between 1980 and 1983. These conferences were attended by over 1,000 professionals from Universities, industry, consultant firms and staff from municipal, provincial and federal governments, and aimed at the transfer of project results as well as exchange of information. This year's conference has been expanded for two days to include Ministry external research in the field of air pollution, in addition to general research projects related to health effects of environmental pollution.

The Research Advisory Committee has also taken the lead in organizing the first government Health Effects Seminar with assistance from the Canadian Centre for Toxicology and Provincial Lottery funding.

b) Application of Research Results:

While some of the Provincial Lottery projects have produced immediate results at their completion by eliminating the danger of spills and/or environmental pollution, others have led to applied projects that have been included in Branch/Region regular work programs. The successful completion of some projects has created a need for new research. For example, the study on the use of ozone as an alternative to chlorine for treatment of drinking water calls for the development of a pilot scale plant at one of the water treatment plants to evaluate the efficiency of this water treatment method. Three such areas are presently under consideration and funding will be covered by the Ministry.

Previous preliminary studies on illness related to swimming in recreational waters have led to an epidemiological study of some Ontario beaches for microbial and viral infections. Other projects are on the way to developing microbiological methods for the testing and identification of coliforms and viruses in lake water.

The Ministry also continues to seek new channels for technology transfer by effective cooperation with other Ontario Ministries, Federal departments and municipalities. This is clearly demonstrated by the joint effort between the ministries of the Environment, Labour, and Health, together with the City of Toronto to investigate the cause of public concern of health effects from industrial pollution in the Junction Triangle area.

Efforts are also made to effectively coordinate MOE research activities with other ministries in the form of joint ventures, sharing of information, mutual review of results, and by participation in research management and planning committees.

Ministry of the Environment's publications have greatly contributed to technology transfer. The publication of project reports, research newsletters, inventory of research, accomplishment reports on scientific research in MOE, research planning, and conference proceedings are just a few examples of this activity.

I. PROJECTS COMPLETED BEFORE 1983

* For more information, please contact:

Policy and Planning Branch
Research Coordination Office

1) CLEAN-UP OF HAZARDOUS CONTAMINANTS AND SPILLS:

1a. Waste Disposal and Treatment:

1PL - Replacement of lead contaminanted soil around three secondary lead smelters; (1977).

2PL - Environmental clean-up of inactive and abandoned mining properties; (1979).

7PL - Radiation control measures in Elliot Lake; (1980).

9PL - PCB clean-up and assessment near Dowlings, Ontario; (1980).

PAC.16 - Development of an acceptable procedure to allow disposal of pesticides containers; (1983).

WM. - North York source separation feasibility study; (1982).

WM.9 - Remote sensing techniques and waste management assessment study; (1982).

1b. Environmental Planning and Management:

WMAB-1 - Economic benefits of materials recycling; (1982).

WMAB-2 - Public involvement in environmental planning, assessment and decision-making; (1982).

WMAB-4 - Development and demonstration of an effective waste reduction program; (1982).

WM-2 - Survey of conventionally non-reputable high-grade waste paper fibre in relation to availability, economics of reclamation, and energy requirements; (1982).

2) RESEARCH DEVELOPMENT COST-EFFECTIVE TECHNOLOGIES FOR IMPROVEMENT IN:

2a. Drinking Water:

4PL - Detection, enumeration and interpretation of levels of viruses in drinking water and bathing water; (1980).

8PL - Chloroform reduction investigation program at Belleville Utilities Commission; (1980).

21PL - Organic contaminants removal from City of Brantford drinking water; (1980).

27PL - Ozone application as an alternative to chlorine for drinking water disinfection; (1983).

29 PL - Biomonitoring of public water supplies; (1981).

2b. Sewage and Sludge Treatment:

12PL - Disposal of sewage sludge on agricultural land; (1980).

13PL - Effects of applying digested sewage sludges to agricultural land lysimeter studies; (1981).

18PL - Development of an experimental marsh treatment facility at Listowel, Ontario; (1982).

28PL - Effect of hydraulic characteristics and effluent chlorination on the incidence of micro-organisms of public health significance in waters receiving sewage treatment plant effluents; (1982).

30PL - Kennedy-Burnett urban stormwater runoff treatment study; (1981).

37PL - Rideau River stormwater management study, Ottawa, Ontario; (1983).

46PL - Compilation of summation report on nine years of research studies on the disposal of sewage sludge on agricultural land; (1982).

57PL - Assessment of the potential for dissemination of environmental contaminants by treatment of wastewater in lagoon system; (1982).

2c. Landfill Construction and Operation:

16PL - Sanitary landfill site investigation at Canadian Forces Base, Camp Borden; (1980).

23PL - The study of gas production and migration at closed landfill sites; (1982).

44PL - Attenuation in groundwater of inorganic contaminants from sanitary landfills, attenuation of leachates; (1983).

WM.7 - Best Pipe (Assessment of landfill gas production); (1983).

WM.8 - Gas migration study; (1982), (Ref; Project PL-23).

WM.10 - Study on landfill research activities; (1983).

2d. Air Quality Effects on Health and the Environment

15PL - An investigation of the health and welfare effects of noise in Ontario; (1980).

17PL - A study on the relationship between hospital admission rates for acute respiratory illness and air quality in several Ontario cities; (1979).

20PL - Epidemiological study to determine the health effects of particulates and SO_2 levels (and other gases) in air; (1981).

32PL - A study to evaluate urban road dust as a source of suspended particulates; (1982).

41PL - Bruce hydroelectric thermal plume definition flights; (1981).

2e. Water Quality Effects on Health:

45PL - Continuation of funding for the virology component of the University of Toronto Epidemiology study of bathing beaches and recreational waters; (1982).

60PL - The Epidemiology of swimming - related illness at selected conservation areas; (1983).

3) RESEARCH TO CONTROL HEALTH HAZARDS FROM CONTAMINANTS:

3a. Hazardous Contaminants and Their Interaction:

3PL - Bioaccumulation rates, acute and chronic effects of five new dielectric fluids on American Flagfish; (1980).

5PL - An investigation of the environmental health hazards associated with road oiling; (1979).

10PL - Chemical identification and biological assay of airborne and waterborne mutagens-carcinogens; (1980).

11PL - Province-wide quantity/location inventories and emission/discharge inventories for specified chlorinated and aromatic hydrocarbons; (1980).

14PL - A study of atmospheric mercury deposition in Ontario; (1981).

19PL - Environmental assessment study on uranium and other elements in plants around Ontario uranium mines; (1980).

22PL - Effect of pH on mercury accumulation in fish; (1981).

24PL - Monitoring fish population in acid stressed lakes of the Haliburton Region; (1980).

25PL - The chemical destruction of hazardous polychorinated organic compounds: a feasiblity study; (1980).

26PL - Increased disease susceptibility after PCB exposure; (1981).

AR-20 - Trace organic contaminants; (1983).

3b. Analytical Procedures:

31PL - Characterization and identification of organic substances in drinking water; (1981).

35PL - Field evaluation of event precipitation samples for use in Acidic Precipitation in Ontario Study; (1981).

39PL - The measurement of total organic chlorine in industrial wastes; (1982).

33PL - The identification of abnormal values of lead and camdium in autopsy material of occupationally exposed individuals; (1982).

34PL - Surface photochemistry of pollutants; (1982).

36PL - Assessment of availability and cost of providing off-site third-party liability coverage protection from damage from disposal facilities; (1980).

43PL - Phase II of an environmental assessment study on uranium and other elements in lichens and mosses form Elliot Lake, Ontario; (1982).

48PL - Review of literature and biological testing protocol required for multiple toxicity evaluation pertaining to hazardous organic compounds; (1981).

59PL - Literature searches regarding the potential genotoxic hazards of specific environmental contaminants; (1983).

ACCOMPLISHMENTS OF COMPLETED PROJECTS:

Development of Improved Methods of Clean-up of Hazardous Contaminants and Assistance towards Clean-up Operations

- Lead deposition around smelting plants (jointly with Toronto lead smelters).
- Radiation contamination of houses at Elliot Lake and Bancroft (jointly with the Federal Government).
- Identification of mine tailings sites and estimation of potential hazard.

Drinking Water

- Removal of hazardous contaminants by activated carbon and by improved alum treatment techniques.
- The use of ozone as an alternative to chlorination for drinking water treatment was investigated and a pilot-scale ozonation system is now under consideration for testing.
- Improved virus identification techniques were developed and are now in use in the MOE laboratory and applied to water and sewage testing.

Sewage and Sludge Treatment

- Development of artificial marsh for sewage treatment (jointly with municipality).
  - techniques for construction of cattail marsh treatment operation established.
  - operational methods were established.
  - similar facilities now being planned in small communities at significant savings over conventional systems.
- Provided data on effects of sludge on agricultural land, allowed development of new sludge disposal policy, and reduced the cost of excessive use of synthetic fertilizers.
- Demonstrated benefits of sewage effluent disinfection to downstream water users.
- The effect of chlorination on bacteria in sewage effluents was demonstrated. A new project has been initiated to use the large amount of data obtained to examine effects on health.
- Establishment of a comprehensive stormwater management plant for the Rideau River which allows for improved

recreational activities and reduced health hazards. There is a good potential for use of the plan in other watershed areas.

- UV disinfection of sewage effluents was investigated; the Ministry presently is evaluating the cost and practical means to use the procedure on a large scale as an alternative to chlorination.

Landfill Construction and Operation

- A study on attentuation of metals in landfill leachates has generated information on migration of leachates, contaminant maps and health effects, which has great importance for future landfill construction and operation.
- Provided data on methane gas migration at closed landfill sites, required in setting land use criteria.

Air Quality and Effects on Health

- A well designed and extensive epidemiological study of the effects of SO_2 and particulates on the lung functions of children in Hamilton schools and homes has been completed. The preliminary report which contains important recommendations is presently under review and has already received publicity. It will show the relative importance of indoor air as a source of pollution.
- The significance of road dust as a source of suspended particulates and the need for dust control strategies has been evaluated. These are implications which are being reviewed, especially for highly industrialized areas in Ontairo.
- Effects of indoor and outdoor air on human health of asthmatic and non-asthmatic cases have been investigated using specially developed portable monitors. Further work is required to expand the findings and examine exposure to other hazardous contaminants.

Water Quality Effects on Health

- A timely earlier epidemiological study on the relationship between micro-organisms and viruses and the occurrence of bathing illnesses at beaches, has led to a larger study being carried out for the Ministry. Results will contribute to solving the Beaches problem.

- An epidemiological study of swimming-related illness at selected conservation sites has led to a major undertaking in 1983 to study recreational waters.

Effects of Hazardous Contaminants

- Information from a literature survey on the carcinogenicity and mutagenicity of some organic contaminants is presently used in the process of setting standards for hazardous contaminants in the environment.
- Tested alternate PCB substitutes and demonstrated minimal environmental health effects.
- Identified normal body burdens of lead and cadmium in vital body organs allowing better evaluation of abnormal levels.
- Demonstrated an alternate technique to pesticide application by the sterilization of breeding females for the control of onion maggots.

Analytical Procedures

- Methods were developed for the detection of viruses in environmental materials with special reference made to the ability of sewage treatment to remove viruses.
- Developed improved biological testing methods for the identification of carcinogenic chemicals.
- Developed improved analytical procedures for the identification and quantification of contaminants.

II PROVINCIAL LOTTERY RESEARCH PROJECTS CONTINUED FROM 1982-1983

Eleven projects continued to progress from previous years required funding in 1983-84. They cover a variety of important subjects:

- Nitrate contamination of domestic well water.
- Statistical models for monitoring groundwater quality near landfill sites.
- Establishment of a marsh sewage treatment system at Listowel.
- Infiltration of water through landfill covers.
- Pollution control in relation to SO_2 emission control in Sarnia.
- Effect of road noise on public health.
- Methods to determine mutagenic and carcinogenic activities of hazardous contaminants.
- Aquatic toxicity of fish from hazardous contaminants.
- Susceptibility to disease after exposure to PCBs.
- Methods for detection of hazardous contaminants in drinking water.
- A fresh water fish test to examine genotoxicity.

The following tables present projects costs in 1983-84, the funds required in 1984-85, the distribution of projects among research institutions and project classification.

Research Organization	No. of Projects	Total Cost $000	Cost in 1983-84 $000	Cost in 1984-85 $000
Universities and Colleges	7	943.0	145.8	99.6
Contractors and Consultants	3	581.0	58.4	31.5
Ontario Research Foundation	1	200.0	10.2	-
Total	11	1,724.0	214.4	131.1

Cost Break-Down Between Research Activities (Projects continued from 1982-83)

Project Classification & Project Activity	No. of Projects	Total Cost $000	Cost in 1983-84 $000	Cost in 1984-85 $000
1. Research to Develop Cost Effective Technology for Improvement in:				
1a. Drinking water	2	171.1	46.0	19.6
1b. Sewage & Sludge Treatment	1	398.3	31.5	31.5
1c. Landfill Construction & Operation	1	29.7	3.0	-
1d. Air Quality Effects on Health	2	183.0	23.9	-
Sub-Total	6	782.1	104.4	51.1
2. Research to Control Health Hazards from Contaminants:				
2a. Hazardous Contaminants & their Interaction	3	704.4	80.5	80.0
2b. Analytical Procedures	2	237.5	29.5	-
Sub-Total	5	941.9	110.0	80.0
TOTAL	11	1,724.0	214.4	131.1

III REVIEW OF NEW PROJECTS STARTED IN 1983-84

The dedications of $1.3 and 1.0 million dollars from Provincial Lottery and the Ministry Regular Budget to MOE research have assisted in continuation of previous projects and the initiation of new high priority ones as summarized in the following examples:

1. Clean-up of Hazardous Contaminants and Spills:

   - study of the impact and environmental behavior of chemicals on groundwater. This information would be especially valuable in cases of spills and environmental emergencies.

   - development of two-dimensional nuclear spill contingency model to assess the impact of accidental discharges of pollutants into the water bodies.

2. Research to Develop Cost-Effective Technology for Improvement In:

   a) Drinking Water:
      - A major project has been initiated to study contaminants removal from drinking water.

   b) Sewage and Sludge Treatment:
      - Project 28PL completed in 1982, has resulted in a large number of data on the disinfection of sewage effluents from micro-organisms of public health significance prior to reaching receiving waters. A new project was initiated to statistically evaluate the data for verification and the development of a model for utilization of research results.

   c) Air Quality and Effects on Health and the Environment
      - a two year study has been initiated for testing municipal incinerators at SWARU for dioxin emissions.
      - a study on the reaction mechanisms and photodegradation of PCBs in air would also deal with contaminants long-range transport.
      - retrospective correlation spectroscopy will be developed to reveal column densities of atmospheric pollutants.

   d) Water Quality and Effects on Health and the Environment
      - an edpidemiological study of recreational waters was initiated for the development of

virus isolation technique prior to its application to survey data.

- the quality of trout farm effluents will be related to farm operation, and the effect of dietary phosphorus on fish growth and wastewater quality will be established.

3. Research to Control Health Hazards from Contaminants

a) Hazardous Contaminants and their Interaction:

- an inter-Ministerial study was initiated to evaluate and determine adverse health effect of residents of the Junction Triangle area in Toronto.
- the volatilization rates of organic chemicals caused by industrial discharges into rivers and streams as sources of hazardous contaminants will be assessed and a model be developed.
- the effects of metals on the microflora of a marsh treatment system is under investigation and might lead to quantitative toxicity assessment.

b) Analytical Procedures:

- a nitrogen oxide monitor will be modified for mounting in an aircraft and mobile laboratories and will be used to survey nitrogen oxides in Ontario.
- the Replicative Killing Assay will be evaluated parallel to the Ame Tests for mutagenicity testing of environmental materials.
- new cost-effective methods will be developed and valuated for the characterization of hazardous organic contaminants in sewages and final effluents.
- a method for sampling hazardous contaminants in air will be developed and evaluated. The reliability of sampling is essential to define human exposure to air pollution and for risk assessment.
- development of methods of concentration of chemicals for mutagenicity testing and chemical analysis of groundwater and leachate in the vicinity of active and closed waste disposal sites is essential for the protection of public health and the environment.
- new sensitive methods will be developed for the analysis of drinking and surface waters as well as incinerator emissions and flyash for ultra-traces of dioxins and furans.

The following lists the important Provincial Lottery projects now underway and their funding in 1984-85:

- The Junction Triangle Epidemiological Study
- The environmental fate of hazardous contaminants and spills
- Research to improve the treatment and quality of drinking water
- Evaluation of UV disinfection of sewage effluents
- Study of dioxin emissions from municipal incinerators
- Epidemiological study of the incidence of disease following swimming at Ontario beaches
- Development of methods for the identification of hazardous organic contaminants in sewages and final effluents
- Development of methods for testing groundwater at landfill sites for mutagenicity
- Development of sensitive methods for detection of dioxins and furans in drinking water
- Study of fecal coliforms and streptococci in receiving water
- Organic hazardous contaminants in the atmosphere.

The following tables show recipients of funds, cost breakdown and project classification.

Research Organization	No. of Projects	Total Cost $ 000	Cost in 1983-84 $ 000	Cost in 1984-85 $ 000
Universities and Colleges	4	357	196.3	109
Contractors and Consultants	4	1,657	732.4	925
Ontario Research Foundation	3	382	116.8	215
Municipalities	1	25	25	-
TOTAL	12	2,421	1,070.5	1,249

Cost Breakdown of 1983-84 Provincial Lottery Projects

Project Classification & Project Activity	No. of Projects	Total Cost $ 000	Cost in 1983-84 $ 000	Cost in 1984-85 $ 000
1. Cleanup of Hazardous Contaminants & Spills	1	142	34	57
2. Research to Develop Cost Effective Technology for Improvement in:				
2a. Drinking Water multi- disciplinary	1	1,000	200	800
2b. Sewage & Sludge Treatment	1	20	15	5
2c. Landfill Construction & Operation	-	-	-	-
2d. Air Quality Effects on Health	1	457.4	457.4	-
2e. Water Quality Effects on Health	2	172.2	137.5	35
Sub-total	5	1,649.6	809.9	840
3. Research to Control Health Hazard from Contaminants				
3a. Hazardous Contaminants and their Interaction	2	65.8	65.8	-
3b. Analytical Procedures	4	563.6	160.8	352
Sub-total	6	629.4	226.6	352
TOTAL	12	2,421.0	1,070.5	1,249

SUMMARY OF CARRY-OVER PROVINCIAL LOTTERY PROJECT COSTS TO 1984-85

		$ 000
1.A	Carry-over from 1982-83 projects	131.1
1.B	Carry-over from 1983-84 projects	1,249.0
	Total carry-over to 1984-85	1,380.1

ANNUAL ALLOCATIONS AND EXPENDITURE OF PROVINCIAL LOTTERY FUNDS

	Allocation	Expenditure
1977-78	$ 1,000,000	$ 724,800
1978-79	2,100,000	1,911,400
1979-80	2,700,000	2,628,300
1980-81	1,800,000	1,799,800
1981-82	900,000	899,900
1982-83	846,800	846,800
1983-84	1,300,000	1,300,000
	10,646,800	10,111,000

IV NEW RESEARCH NEEDS IN 1984-85

The Ministry is now following a new Research Planning Process that utilizes the expertise of MOE specialists to develop a cost-effective and comprehensive research plans to cover both short and long-term needs for the 80's. Consolidation of research efforts is an integral part of this plan which is developed by four working groups:

1. Air Research
2. Water Research
3. Liquid and Solid Waste Research
4. Analytical Method Development.

Each of these working groups is composed of specialists not only from MOE Branches directly involved, but also from other Branches with research interests. The effort is coordinated by the Research Coordination Office - Policy and Planning Branch and managed by the Research Advisory Committee to ensure that the developed research plan is in harmony with MOE Strategic Issues, Policy and Priorities and meets the criteria for the approval and management of Provincial Lottery Proceeds.

Technology transfer and utilization of research results are integral parts of the plan.

The Research Planning Working Groups have identified 114 research needs covering environmental management, improvement of the quality of air, water and the ecosystem, interaction and fate of hazardous contaminants, and health implications from pollution.

The research needs planned for funding in 1984-85 are identified in a separate report available from the Policy and Planning Branch.

Impact on Environmental Health Related Research

Public concern over health related environmental problems with respect to air pollution, drinking water, waste and recreational waters, disposal of liquid and solid wastes, fish toxicity, injury to Ontario crops by ozone and other atmospheric contaminants, etc. has never been greater than in 1983.

On the issue of treatment of drinking water alone, the Ministry is launching a research program costing $1.0 million. The possibility of health hazard from air pollution has obliged the Ministry in 1983 to initiate the SWARU study at a cost of over $0.5 million, to investigate the possibility of production of dioxins at municipal waste incinerators. This one year study may generate further projects concerned with air emission effects on public health.

The financial and educational impact of the proposed research program will benefit research by universities, colleges and consultant firms, as well as by the planned Canadian Centre for Toxicology. The wide participation of these research institutions will lead to greater public confidence in the Ministry's programs.

Ministry health-oriented research funded from Provincial Lottery proceeds is complimented by other environmental research funded through the regular budget including work conducted internally and services provided by the Ministry Branches and Regions.

The progress made on research and the results obtained are discussed at the Ministry's Technology Transfer Conferences and in Ministry publications.

FINANCIAL INFORMATION OF ONGOING PROJECTS FUNDED BY COMBINED PROVINCIAL LOTTERY AND REGULAR RESEARCH FUNDS*
1983-84

These projects are directed towards the solution of environmental and health related issues with a particular focus on hazardous contaminants in air, water and waste. They are summarized in the following table.

Project Classification and Project Activity	No. of Projects	FUNDING		
		Total x $1000	1983-84 x $1000	1984-85 x $1000
1) Clean-up of Hazardous Contaminants & Spills	2	161.2	53.4	57.0
1a. Waste Disposal & Treatment				
1b. Environmental Planning & Management				
2) Research to Develop Cost Effective Technology for Improvement in:				
2a. Drinking Water	3	1,171.1	121.0	519.6
2b. Sewage & Sludge Treatment	4	514.9	65.7	51.5
2c. Landfill Construction & Operation	1	38.7	13.3	-
2d. Air Quality Effects on Health	14	1,379.9	621.0	81.5
2e. Water Quality Effects on Health	3	335.6	135.9	34.7
Sub-total	25	3,440.2	959.9	635.8
3) Research to Control Health Hazards from Contaminants				
3a. Hazardous Contaminants & their interaction	15	1,958.7	367.1	481.3
3b. Analytical Procedures	21	1,556.9	486.5	464.8
Sub-total	36	3,515.6	853.6	946.1
TOTAL	63	7,117.0	1,866.9	1,638.9

* Excluding projects funded by the Pesticides Advisory Committee

DISTRIBUTION OF RESEARCH FUNDS*
1983-84

Organization	No. of Projects	Total Cost $ 000	Cost in 1983-84	Cost in 1984-85
Universities	42	3,604.9	855.0	460.9
Consultants/Contractors	19	3,344.8	983.9	1,229.5
Government	2	167.3	25.0	-
TOTAL	63	7,117.0	1,863.9	1,690.4
Distribution by University				
Waterloo	5	726.6	186.3	201.7
Guelph	7	502.4	101.4	7.0
Lakehead	1	170.2	5.2	-
McMaster	4	485.2	68.0	-
Ryerson	1	49.0	-	-
Toronto	11	814.7	229.5	133.7
Trent	1	43.6	22.0	-
Queens	1	41.0	17.0	-
Windsor	2	88.8	39.4	-
York	9	683.4	186.0	118.5
TOTAL	42	3,604.9	855.0	460.9

* Excluding projects funded by the Pesticides Advisory Committee

SUMMARIES OF INDIVIDUAL PROJECTS

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* A paper was presented at the Technology Transfer Conference No. 4, held on November 29 & 30, 1983 on projects marked with an astirisk.

1 - CLEAN-UP MANAGEMENT OF HAZARDOUS CONTAMINANTS AND SPILLS

1a. Waste Disposal and Treatment
1b. Environmental Planning and Management

1a. Waste Disposal and Treatment

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 1a. Waste Disposal & Treatment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
104 PL	"Assessing the Impact of Hazardous Liquids Spilled onto Soil"	University of Toronto	- To develop methods for predicting contaminant dispersal and attenuation arising form hazardous liquid spills onto soil. - To study the environmental fate of chemicals with a special attention to immiscible liquids.	$141,750 1983-87	Funding: 83-84 - $34,000 84-85 - $57,000 Information will be obtained on penetration rates of contaminants, their interaction with groundwater, retention in soil, vapourization rates. This information is required for setting criteria and in cases of emergency spills.

1b. Environmental Planning and Management

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 1b. Environmental Planning and Management

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
111 RR	"Ottawa River Nuclear Spill Contingency Model Development"	Gore & Storrie	- To develop a two-dimensional pollutant dispersion model for assessing the impact of accidental discharges into water bodies and to define methods for linking near and far spills, mixing and convective period zones.	$ 19,380 1983-84	Funded by a contract The results will be used to predict the arrival time and concentration of spilled hazardous chemicals.

2 - RESEARCH TO DEVELOP COST EFFECTIVE TECHNOLOGY FOR IMPROVEMENT IN

2a. Drinking Water
2b. Sewage and Sludge Treatment
2c. Landfill Construction and Operation
2d. Air Quality Effects on Health and the Environment
2e. Water Quality Effects on Health and the Environment

2a. Drinking Water

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2a. Drinking Water

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
62 PL	"Investigations of Nitrate Distributions and Nitrogen Transformations in a Shallow Sandy Aquifer near Alliston, Ontario"	University of Waterloo	- To study nitrate contamination of domestic well water, and develop an alternate groundwater nitrate removal procedure.	$141,100 1982-85	In progress. Reporting date is 1985. The findings will be used to reduce or eliminate the problem of nitrate contamination of domestic well water in agricultural areas of Ontario.
63 PL	"Design of Groundwater Monitoring Programs for Waste Landfill Sites"	University of Toronto	- To apply statistical methods and models to monitoring groundwater quality at various landfill sites.	$ 30,000 1982-84	In progress. Reporting date is 1985. This matter has been a major issue for MOE. The results will be used for monitoring groundwater quality causing public concern.
99 PL	"Trace Organic Contaminant Removal from Drinking Water"	contracts	- To assess the effectiveness of drinking water treatment for organic contaminants removal and the use of activated carbon absorption as an add on contactor - To determine process operational parameters	$1,000,000 1983-86	Funding: 83-84 - $ 75,000 84-85 - $500,000 85-86 - $425,000 Demonstrated capacity of hazardous contaminants removal from drinking water.

2b. Sewage and Sludge Treatment

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2b. Sewage and Sludge Treatment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
54 PL	"Application of Ultraviolet Disinfection Technology in Ontario WPCP Effluents"	Standard Biological Laboratories Ltd.	- A pilot scale UV disinfection unit will be used to establish the efficiency and performance of the method applied to sewage effluents.	$41,000 1981-83	Completed. Report is expected in 1984. The results will be used to establish UV design guidelines for disinfection of sewage treatment effluents and eliminate health hazards.
18 PL	"Development of an Experimental Marsh Treatment Facility at Listowel, Ontario"	Gore & Storrie Ltd.	- Monitoring and operation of the established marsh treatment system.	$398,300 1979-85	In progress. Funding: 84-85 - $31,500 System developed and in operation for sewage treatment. Project results have led to construction of a demonstration system at Port Perry.
65 RR	"Hazardous Contaminants in Hamilton WPCP"	Canviro Consultants Ltd.	- To estimate annuyal loadings of hazardous contaminants in WPCP discharges into Hamilton Harbour. - To assess contaminants' removal efficiency through analysis of season samples.	$55,600 1982-84	Completed in 1983. Report in 1984. Identification of the types and quantities of hazardous contaminants in raw sewage and sewage effluents would assist MOE: 1. to establish the efficiency of treatment; 2. to use the data as "finger-print" of possible sources of pollution in an industrial area

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2b. Sewage and Sludge Treatment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
105 PL	"Evaluation of Beak Data on the Effects of Hydraulic Characteristics and Effluent Chlorination on the Incidence of Micro-organisms of Public Health Significance in Receiving Waters"	contract	- To evaluate statistics used in project 28 and devise alternatives if inappropriate. - To integrate data in model and conduct statistical analysis.	$29,000 1983-85	Funding: 84-85 - $20,000 Data generated from project 28 require statistical evaluation prior to its use in setting a standard for effluent disinfection from micro-organisms.

2c. Landfill Construction and Operation

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2c. Landfill Construction and Operation

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
58 PL	"Field Measurements Infiltration Through Landfill Covers"	Gartner Lee Ltd.	- To study infiltration of water through various types of cover materials used in the construction of landfill sites. - Field data will be collated for one year and verified for reliability	\$38,700 1982-84	In progress. To be completed in 1984. The anticipated results will assist MOE in preventing infiltration of hazardous contaminants, possibly present in landfills, to groundwater. * Additional \$9,000 were approved to carry out new experiments.

2d. Air Quality and Effects on Health and the Environment

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2d. Air Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
40 PL	"Effects of Ambient Air Pollution (Assessed by Personal Indoor and Outdoor Monitoring) on Humans"	Gage Institute, University of Toronto	- To assess health effects of air pollution using personal monitors for several air contaminants. 90 asthmatic and non-asthmatic cases were evaluated.	$161,000 1979-82	Completion date is 1983-84. $200,600 additional funds were granted by Health & Welfare and the U.N. World Health Organization. A portatble personal monitor was developed for assessment of human exposure.
47 PL	"Investigation of Sleep Disturbance Effects of Road Traffic Noise"	Wilson & Associates	- To determine the relationship between road traffic noise and sleep disturbance and their effects on public health. Literature information will be reviewed and recommendations presented.	$153,000 1980-84	In progress. To be completed in 1984. The anticipated results would assist in reviewing noise criteria and predicting effects of noise levels on humans.
56 PL	"Controlling Sulphur Dioxide Emissions. What Are The Costs?"	University of Toronto	- To examine the economics of SO_2 emission control in Sarnia or Nanticoke industrial complexes. - Enforcement and abatement policies will be examined.	$30,000 1981-present	In progress. Completion 1984. Comparison between alternative pollution control enforcement policies will focus on cost effective method for SO_2 reduction.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2d. Air Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
70 RR	"Production of Ozone Insensitive Field Bean Varieties"	University of Guelph	- Ozone tolerance of beans will be investigated in hope of production of ozone insensitive varieties.	$54,800 1980-84	Funding: 83-84 - $15,500 Final report expected in March 1984. Progress made was presented at ARB Seminar.
71 RR	"Development of a Strategy for Predicting the Impact of Fast Food Restaurants on the Surrounding Community"	University of Windsor	- Ambient and source sampling will be evaluated including laboratory simulation.	$27,400 1981-84	Funding: 83-84 - $7,400 Ongoing - a model is to be developed. Progress report presented and discussed at ARB Seminar.
72 RR	"Assessment of Impact of Oxidant Injury on Potato and on the Development of Early Blight"	University of Guelph	- Ozone injury to potato and the use of chemical protectants will be assessed.	$82,100 1980-84	Funding: 83-84 - $17,400 To be completed in 1983. Progress report expected in March 1984.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2d. Air Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
66 RR	"Monitoring Genotoxicity in the Atmosphere using Sister Chromatid Exchange in Mice"	University of Windsor	- To develop a straight forward procedure and ongoing monitoring of the atmosphere for agents genotoxic to a mammalian system.	$61,400 1982-84	Funding: 83-84 - $32,000 In progress. The study will complement MOE activity in genotoxicity, hazard and risk assessments, and should assist in Standard Setting by providing the measurement technique of real-life air pollutant mixtures, using mice as representatives for the mammalian system.
69 RR	"A Mass-Spectrometric Study of Selected Air Pollutants"	Trent University	- To investigate the reaction mechanism and specific rates of 9 PAH's including oxidation reactions.	$43,600 1982-84	Funding: 83-84 - $22,000 In progress. The reaction of PAH's in air are not fully understood. The Ministry has produced a large analytical database. The obtained information, together with MOE efforts to improve PAH sampling, would assist in producing reliabe data that is required for setting some guidelines. The project complements 4 MOE studies.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2d. Air Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
88 RR	"Study of Inhalable Particulate at Regional Sites"	Air Resources Branch	- To test the performance of dichotomous samplers, and use them to determine the correlation between total and suspended particulate matter in air at 8 Regional industrial locations in Ontario.	$142,250 1982-84	In progress. The funds will be used to purchase 8 air samplers. ARB, together with MOE Regions, will provide other necessary resources. Purchase of equipment would increase ARB technical capabilities.
93 PL	"Diagnostic Testing of the SWARU Installation in Hamilton"	ORF & Envirocon Contracts	- To conduct sampling and analyses of SWARU emissions and flyash and optimize SWARU oeprating conditions to minimize formation of dioxins. - To modify equipment if required.	$457,300 1983-84	In progress. This is part of a two-year study for testing municipal incinerators. The results would provide some answers on the problem which is causing public concern.
100 RR	"Dispersal of Airborne Particulates on a Short and Long-Term Scale"	Queen's University	- Heavy metals in air samples will be measured using proton induced x-ray emission. The results will be correlated to those obtained on tree rings.	$41,000 1981-84	Funding: 83-84 - $17,000 In progress. Completion date, 1984. Background heavy metal data will be used to establish short and long-term dispersal of industrial emissions.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2d. Air Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
101 RR	"Restrospective Correlation Spectroscopy and its Application to Atmospheric Monitoring"	York University	- To develop retrospective correlation spectroscopy techniques for observational atmospheric spectral data handling. Computer software will be developed and applied to field atmospheric data.	$43,500 1983-86	Funding: 83-84 - $13,000 84-85 - $14,500 In progress The results would reveal column densitites of atmospheric molecular pollutants and the identification of more than one species at a time.
107 RR	"Gas Phase Photochemistry of Polychlorinated Biphenyls"	University of Guelph	- To study photochemistry and reaction methanisms of PCB in air and nitrogen.	$22,500 1983-8	Funding: 83-84 - $15,500 84-85 - $ 7,000 In progress. The results would provide a better understanding of the photodecomposition and long-range transfer of PCB in air.
115 PL	"Survey of Blood Lead Levels in School Children"	Contract	- To determine blood lead levels on school children in Ontario communities with known above average ambient air lead concentrations.	(-) 1984-85	The results are essential for hazard and risk assessment to public health.

2e. Water Quality and Effects on Health and the Environment

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2e. Water Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
49 PL	"Aquatic Toxicity Studies of Multiple Organic Compounds"	Lakehead University	- To determine aquatic toxicity of selected hazardous contaminants to fish. Application to industrial organics will also be carried out.	$170,200 1981-84	Completed Reporting: 1984 Prov. Lottery $147,200 Haz. Cont. Office 15,000 H. C. Funds 8,000 Total $170,200 The study provides information on fish toxicity and leads to: 1. toxicity to fish; 2. use of fish as an indicator for pollution; 3. informtion on interaction of composite chemical mixtures.
89 PL	"Epidemiological Studies of Disease Incidence and Recreation of Water Quality at Selected Areas in Southern Ontario"	University of Toronto	- To determine techniques for isolation of viruses. - To conduct epidemiological studies of bathers illness. - To correlate the findings. - To establish procedures for computer analysis of epidemiological survey data.	$149,000 1983-85	Funding: 83-84 - $114,300 84-85 - $ 34,700 In progress This information is required to evaluate recreational water standards and to substantiate existing water quality criteria.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 2e. Water Quality Effects on Health and the Environment

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
94 RR	"Water Quality Analysis of Trout Farm Effluent"	University of Guelph	- To determine water quality of Trout farm effluents and correlate the results to operating practices. - To determine the effects of dietary phosphorus on growth and physiology of fish, and on wastewater quality.	$16,400 1983-84	In progress. Reporting date: July 1984 The results will provide technical basis for MOE criteria on aquaculture effluents.

3 - RESEARCH TO CONTROL HEALTH HAZARDS FROM CONTAMINANTS

3a. Hazardous Contaminants and Their Interaction
3b. Analytical Procedures

3a. Hazardous Contaminants and Their Interaction

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
42 PL	"Development of Non-Chemical Approaches to Pest Control (Sterile Male Onion Maggot Technique)"	University of Guelph	- To construct a facility for pest control studies. 300 acres of onions in Keswick will be used for field testing.	$237,500 1980-83	In progress. Reporting date is 1984. In cooperation with MA&F and Agriculture Canada. Successful demonstrations are being made for control of pests without the use of toxic chemicals and pesticides.
74 RR	"Evaluation of Contaminated Water and Soil Sites as Sources of Airborne Hazardous Materials"	University of Toronto	- To determine the rate of volatilization of organic pollutants from water and soils.	$51,000 1982-85	Funding: 83-84 - $17,000 Systems were set up for partition coefficient measurements. Water volatilization system developed. Soil volatilization system is under development It is early to foresee the implementation of results.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
73 RR	"Sweet Corn and Green Bean Response to Air Pollution in Southern Ontairo"	University of Guelph	- To determine the efficiency of chemical protectants against ozone for sweet corn and green beans.	$51,600 1982-85	Funding: 83-84 - $17,500 In progress. A progress report is expected in March.
90 RR	"Suppression of Immune Defences by Halogenated Aromatic Compounds"	McMaster University	- To examine the effect of PCBs and PPBs on immune systems and related disease. - To establish effects caused by exposure of mice to PCB and dioxins.	$233,000 1979-83	Completed. Reporting in 1984. Funding: MOE Prov. Lot. $113,100 MOL Prov. Lot. 50,800 MOE H.C. Funds 69,100 Total $233,000 The obtained information will be valuable for understanding exposure to hazardous chemicals.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
84 RR	"Collaborative Study on Short-Term Tests for Genotoxicity and Carcinogenicity"	York University and MOE	- To participate in a U.N. international study on genotoxicity and carcinogenicity of a group of hazardous chemicals. - To apply above to 6 compounds selected from MOE List of Chemicals of Concern.	$60,000 1982-83	In progress. Completion date is 1983. Reporting in 1984. To prove the validity of MOE testing capabilities at an international level. The results obtained on 6 compounds will be used in standard setting, and will complement other MOE projects.
91 RR	"Chemical Identification and Biological Assay Studies of Environmental Mutagens, Promoters and Inhibitors" (Provincial Lottery Project 55)	York University	- To determine mutagenic and carcinogenic activities of hazardous contaminants using newly developed methods. - To determine biohazards of individual and mixtures of contaminants.	$402,800 1981-84	In progress. Completion date is 1984. Funding: 83-84 - $80,500 84-85 - $80,000 *82-83 - $50,000 (*from Hazardous Contaminants) Additional funding: $402,800 paid by Provincial Lottery Trust Funds. This information is essential for the establishment of health hazards, risk, standards and criteria for these chemicals.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
68 RR	"Experimental and Environmental Modelling Studies of Hazardous Substances in Ontario"	University of Toronto	- To study environmental fate of specific toxic substances and devise novel hazard assessment methods. The developed model will be extended to include human exposure	$165,000 1982-85	In progress. Funding: 83-84 - $26,000 84-85 - $58,000 Chemicals selected from MOE List. Standard setting involves: collation of informaiton, knowledge of fate of chemicals, hazard assessment, exposure, risk and criteria. Two of these are dealt with in this study.
87 RR	"A Biological Model for Partitioning of Mercury, Lead, and Cadmium in Aquatic Systems"	University of Toronto	- To investigate the fate of some toxic metals and their bio-accumulation. - To study the use of algae for biomonitoring of aquatic pollution. - Use the data in a "unit world" microcosm.	$13,000 1982-84	In progress. Completion date is 1984. The following is anticipated: - information on bioaccumulation of 3 metals. - biomonitoring. - fate of metals in the aquatic system.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
95 PL	"Toronto Junction Triangle Health Study"	City of Toronto and Ministry of Health	- To evaluate health effects from industrial pollution at Junction Triangle. - To determine abnormalities of still-birth and dealth rates of Junction Triangle residents compared to other areas of Toronto.	$25,000 1983-84	Funding: $75,000 equally divided between MOE, MOH and MOL; $81,900 additional from City of Toronto. This study is in resposne to public concern from industrial pollution at Junction Triangle.
106 RR	"Determination of Volatilization Rates of Organic Chemicals of Public Helath Concern"	Gore & Storrie Ltd.	- To determine volatilization rates of organic compounds of public helath concern in provincial streams and rivers and correlate these to bulk flow characteristics. - To establish the relationships between chemical structures and volatilization rates.	$24,100 1983-84	The results would be useful in assessing the transport and fate of organic chemicals entering provincial streams.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
108 RR	"Contaminant Mobilization and Uptake from Mine Tailings at Cobalt, Ontario"	Hanna Associates Ltd.	- To determine the mobility and bioavailability of contaminants, primarily heavy metals, in mine tailings under varying moisture and chemical regimes. Field monitoring will be correlated to laboratory testing.	$49,435 1983-85	In progress. Funding: 84-85 - $25,000 The effects of building a marsh system on tailings and subsequent flooding with sewage effluent will be defined in relation to mobilization rates of heavy metals under natural conditions. Potential health and environmental effects will be identified.
109 RR	"Effects of Metals from Mine Tailings on the Microflora of a Marsh Treatment System"	University of Toronto	- To assess the effects of metals on the normal microflora of a marsh treatment system. - To determine the effect of pH on the toxicity of effluents. - To compare metal susceptibility of bacteria from mine tailings and normal marsh system.	$49,000 1983-85	Funding: 84-85 - $25,000 The potential toxic effects of metals on the microflora of a marsh system at Cobalt will be determined. Quantitative toxicity assessment will be performed.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
114 PL	"Effects on the Muscle of Young Fish and Rats of Exposure to Lead, Cadmium and Mercury"	York University	- To study enzymatic effects and genetic activities on fish and young rates due to exposure to lead, cadmium and mercury and to examine RNA alterations. - Enzyme reactions in fish due to exposure to metals will be investigated.	$16,310 1983-84	Funded by a grant of $16,310. Test animals and fish will be examined with respect to functional activities, protein synthesis and genetic changes due to exposure to toxic metals.
117 RR	"To Investigate the Short-Term Test Mutagenicity and Chemical Composition of Benzene Extractable Fractions of Coke Oven Emissions"	Contract	- To study coke oven emissions, compare benzene and possibly other solvent extractable fraction, mutagenicity testing, and chemical analysis of air particulates. Potential correlation between short-term mutagenicity results and human health effects.	$ 1983-86	Contract in preparation. Reporting 1986. To establish a scientific base for setting standards or guidelines of PAH in air.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3a. Hazardous Contaminants and Their Interaction

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
118 PL	"Occurence and Mobility of Hazardous Organic Chemicals at Ontario Landfills"	University of Waterloo	- To study and determine the nature, concentrations and mobility of hazardous organic compounds that occur in groundwater at representative municipal landfills in Ontario.	$331,000 1983-87	Grant funding: 83-84 - $ 61,300 84-85 - $107,300 To establish a basis for the evaluation and hazard assessment of groundwater contaminantion at landfills.

3b. Analytical Procedures

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
61 PL	"Development of a Methodology for the Concentration and Detection of Rotaviruses and Hepatitis A Virus in Environmental Samples"	University of Toronto	- To develop sensitive methods for the detection of viruses in sewage effluent and surface water	$49,000 1982-84	In progress. Reporting date is 1983. The information obtained will be used to assess the efficiency of Ontario Sewage Treatment Plant operation for the protection of the public from virus infections.
64 PL	"The Development of a Freshwater Fish Test to Identify Aquatic Toxic Contaminants"	University of Guelph	- To develop methods for genotoxicity testing of fish caused by aquatic contaminants.	$37,500 1982-84	Funding: 83-84 - $19,300 In progress. Completion date is 1984-85. The developed state-of-the-art test will be used to evaluate the aquatic toxicity of hazardous chemicals.
79 RR	"Development of a Tunable Diode Laser-Based Hydrogen Peroxide Monitor"	York University	- Development of a spectrometer to measure hydrogen peroxide concentrations in air, and conduct a feasibility study for measuring ammonia and formaldhyde in air.	$58,500 1982-85	Funding: 83-84 - $19,500 84-85 - $24,000 In progress. Accurate measurements of hydrogen peroxide, ammonia and formaldhyde would provide a better understanding of SO_2 oxidation to sulfuric acid in the atmosphere.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
81 RR	"Synthesis of Polynuclear Aromatic Hydrocarbons of Interest in Environmental Pollution"	York University	- To prepare specific PAHs. Samples will be used as standards.	$13,500 1982-84	Funding: 82-83 - $6,500 83-84 - $7,000 Air samples can be used as standards for qualitative purposes only. The study can be complementary to other MOE activities on PAHs.
80 RR	"Chemical Speciation of Particulate Matter"	McMaster University	- To develop procedures for chemical composition of airborne particulate matter using Neutron Activation Analysis.	$49,230 1980-83	Funding: 82-83 - $15,000 83-84 - $13,000 Completion date is 1984. Reporting Date is 1984. A change has been made to perform speciation-analysis by chemical methods.
82 RR	"Laser Induced Emission Spectroscopy of Polycyclic Hydrocarbons in Low Temperature Matrices"	York University	- To develop a laboratory capability to obtain fluorescence spectra of PAHs.	$53,800 1982-85	Funding: 83-84 - $14,700 In progress. The study is complementary to several MOE projects on PAHs.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
78 RR	"Methods for the Sampling and Analysis of Nitro-substituted Polycyclic Aromatic Hydrocarbons"	McMaster Univeristy	- To synthesize nitro-PAHs and develop analytical methods. - To use above to examine auto exhaust and urban air for the presence of PAHs.	$101,000 1979-84	Funding: 83-84 - $28,000 In progress. Completion date is 1983. Developed GC/MS analytical methdos now in use in MOE Laboratory. PAHs were synthesized for use as standards.
75 RR	"Provision of PAHs and Aza-PAHs as Environmental Analytical Standards"	University of Waterloo	- To synthesize PAHs and Aza-PAHs for use as analytical standards.	$69,900 1981-84	Funding: 83-84 - $26,000 In progress. Completion date is 1984. PAH compounds were prepared and presented to MOE Laboratory for use as standards.
77 RR	"Multielement Determination of Metals and Metal Compounds in Air and Related Samples"	University of Toronto	- To develop analytical techniques for different chemical states of metals using GC-AFS.	$94,500 1979-84	Funding: 83-84 - $18,000 In progress. Completion date is 1983. Developed methods for mercury. Methods for other metals are planned. Progress report should be reviewed for comment.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
83 RR	"Methods for the Sampling and Analysis of Asbestos Air Pollution in Ontario"	McMaster Univeristy	- To obtain and relate data on asbestos in outdoor air using Electron Microscopy and Optical Microscopy.	$102,000 1981-84	Funding: 83-84 - $27,000 In progress. Completion date is 1984. Methods were developed and verification is in progress.
85 RR	"Evaluation of Pulsed Nuclear Magnetic Resonance Technique in the Analysis of Environmental Samples"	Ryerson Polytechnical Institute	- A new NMR instrument will be used to develop methods for the characterization of organic compounds in wastes.	$49,000 1982-83	In progress. Completion date is 1984. A newly developed NMR will be purchased and analytical methods developed. The completed work, training, and the instrument will add to MOE Laboratory capabilities.
67 RR	"To Devise and Implement a Revised Monitoring Scheme for Persistent Toxic Chemicals in Great Lakes Sports Fish"	Zenon Environmental Inc.	- To develop and implement new monitoring methods for the characterization of persistent chemicals in Great Lakes fish.	$130,000 1982-85	Funding: 83-84 - $80,000 An internal component of the project will be carried out in the MOE Laboratory. The Water Resources Branch will provide previous data. This issue is of concern to both Provincial and Federal Governments.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
96 PL	"Development of a Non-GC/MS-Oriented Protocol for Routine Analysis of Organic Trace Contaminants in Municipal WPCP Raw Sewage and Final Effluents"	contract	- To develop a protocol for the characterization of organic contaminants in sewage and final effluents. - To validate the developed methodology and document it for transfer and use by MOE Laboratories	$180,000 1983-85	Funding: 83-84 - $ 60,000 84-85 - $120,000 A cost-effective method will be developed to estimate the levels of organic contaminants in sewage prior to disposal on receiving water or land.
97 RR	"Development of Computer Program for Mass- Spectrometry Data Interpretation"	contractor	- To review and develop computer techniques for identification, quantification and quality control of Mass-spectrometer data.	$88,000 (est.) 1983-85	The developed computer programs would improve sample throughout for cost-effective detection of trace organics in environmental samples without jeopardizing data quality or increase of staff.
98 RR	"Organic Contaminants in the Atmosphere Effects of Absorption Tube Storage and Sample Handling Techniques on Measured Values"	ORF	- To determine the optimum storage and handling conditions for organic air sampling tubes, and assess the effect of storage and reliability of sampling for hazardous contaminants.	$40,800 1983-85	Funding: 83-84 - $25,800 84-85 - $15,000 The successful completion of the research would have a great impact on MOE air pollution abatement programs and on setting accurate criteria for human exposure.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
112 RR	"Comparison of the Ames Test and the Replicative Killing Assay as Detectors of Mutagenicity in Chemical Compounds and Environmental Samples"	York University	- To evaluate the replicative killing assay as an adjunct to Ames test for mutagenic activity and to compare the specificities and sensitivities on mutagenic standards and concentrated water samples.	$13,000 1983-84	Funded by a grant. The test has shown potential for mutagenicity testing. 15 model compounds will reveal its reliability for use at the MOE Laboratory.
113 PL	"Differentiation of Fecal Coliforms and Fecal Streptococci and Verification of Newer Tests to Determine Human and Non-Human Feces"	University of Toronto	- To develop microbiological methods for E. Coli and Entrococci for specific identification of fecal pollution. The new methods will be validated and interrelated to present methods.	$23,200 1983-84	Funded by a grant. The Ministry will increase its analytical capabilities in microbiological testing of effluents, waters and sewages.
102 PL	"Studies of Methodology and Instrumental Capabilities for Optimum and Rapid Analysis of PCDD and PCDF Compounds in Water"	University of Waterloo	- To develop sensitive methods for trace determinants of dioxins in drinking and surface waters and incinerator ash and verify these methods.	$42,800	Funding: 83-84 - $25,000 84-85 - $17,800 In progress. Great concern of public and government is caused by insufficient information on dioxins in the environment. Remedies of problems and standard setting require improved detection limits for dioxins.

RESEARCH COORDINATION OFFICE

Research - 1983-84 Program: 3b. Analytical Procedures

	Title	Organization	Purpose	Cost & Duration	Benefit to MOE Programs/ Comments
103 PL	"An Extraction and Concentration Method for the Testing of Landfill Leachates, Soil Fractions and Liquid Industrial Wastes for Genotoxic Organic Compounds"	ORF	- To develop and validate methods for mutagenicity testing of leachates and groundwater.	$300,000 1983-86	Funding: 83-84 - $ 25,000 84-85 - $150,000 85-86 - $125,000 The developed methods will be used for assessment of environmental contamination on populated areas in the vicinity of active and/or closed waste disposal sites.
110 RR	"Modifications to Chemi-Luminescent Instruments of NO and NO_2 from an Aircraft and a Mobile Laboratory"	York University	- To modify existing nitrogen oxide detectors for use to measure NO and NO_2 in tropospheric air from aircraft and mobile laboratory.	$22,200 1983-84	Funded by a grant. The instrument will be used by MOE for testing urban plume and transporting models at high sensitivity.

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